The evolution of sheep immunity in response to nematode infection

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There is considerable variation in the distribution of the number of parasites amongst a flock of lambs infected with gastrointestinal nematodes. One hypothesis that could explain the observed heterogeneity is that hosts evolve immune phenotypes of varying strengths when infected. The acquired immune response that is mounted by infected lambs is composed of two components. The IgE immune component which regulates parasite numbers within a host, and the IgA immune component which lowers adult parasite fecundity rates, hence decreasing the number of infective agents that are released by the host back into the communal pasture area. In this study, we use adaptive dynamics to study the evolution of the IgE and IgA immune phenotypes, and we use lamb weight as a measure of host fitness. We found that processes affecting the evolution of the lamb immune phenotypes are: the assumed trade-off relationship between the IgE and IgA immune responses, variation in immune costs, and the sensitivity of host maintenance efficiency to the presence of adult nematodes and seasonality. A key finding is that we can obtain a dimorphic population that emulates field studies when the presence of adult nematodes severely reduces hosts maintenance efficiency, and the IgE cost is low while the IgA cost is high. Overall, this study provides insight on the processes that could lead to variation in immune phenotypes of lambs infected with nematode parasites.

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